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ABSTRACT

In contextualized instruction, the critical features of a context are considered important for the acquisition and transfer of a skill. Examples of contextualized instruction programs are Functional Context Education (FCE) and Anchored Instruction (AI). FCE involves the teaching of reading and mathematics skills in contexts that are relevant to the learner. AI is called "anchored instruction" because the practice of target skills is anchored to a specific context in which students use target skills in order to solve a series of problems. One of the primary goals of contextualized instruction is to increase the likelihood that what is taught in the training or classroom setting will be used in future applicable settings. Behavior analysts have developed a detailed technology to promote such transfer. Transfer requires that relevant behaviors be taught in relevant contexts. Relevant contexts are characterized by the critical features of target settings. A number of tactics have been developed to introduce and highlight critical features. These include introducing maintaining contingencies, using common stimuli, using sufficient exemplars, training loosely, and promoting precision. In this document, each of the techniques is described in detail. Conditions promoting errors in transfer settings and the development of error patterns are also described. Concluding discussion takes up the issue of whether relevant behaviors are being taught in relevant contexts by FCE and AI. (RH)

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Contextualized Instruction:
Teaching Relevant Behaviors in Relevant Contexts

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Contextualized instruction is teaching a skill within a specific, preferably, functional context. In contextualized instruction, the critical features of a context are considered important for the acquisition and transfer of a skill. For example, a vocational literacy program would be contextualized if reading skills were taught within the context of a vocational area. In opposition, decontextualized instruction teaches skills in a variety of unrelated contexts. An example of a decontextualized literacy program is one that teaches reading skills by selecting readings from a variety of subject areas. Examples of current contextualized instruction programs are Functional Context Education (FCE) (Sticht, 1987) and Anchored Instruction (AI) (Vanderbilt Cognition and Technology Group). FCE teaches reading and mathematics skills in functional contexts, typically vocational. AI teaches reading, writing and mathematics to elementary school students in specially created "macrocontexts."

Two Contextualized Instruction Programs

Functional Context Education

Functional context education, a termed first coined by Shoemaker (1960), advocates teaching reading and mathematics skills in contexts that are relevant to the individual (Sticht, 1975; Sticht, Armstrong, Hickey & Caylor, 1987). It has its widest application in the field of adult literacy. According to Sticht et al. (1987), the two major goals of a functional context approach are to (a) always make the instruction as meaningful as

possible to learners by relating it to their prior knowledge; and (b) use, as much as possible, "real life" situations, tasks, and materials that the learner will encounter after training. Some of the best known examples of functional context education are programs developed for the U.S. Army (Sticht, 1987).

The Functional Literacy Project In an attempt to improve the reading skills of low aptitude recruits, the army implemented a remedial reading course called the Functional Literacy (FLIT) project (Sticht, 1975). FLIT was the Army's first project specifically intended to teach specific literacy skills appropriate to job reading requirements. To develop reading materials, the project team analyzed the work tasks soldiers performed, and identified the basic skills needed to perform each job (Sticht, 1975). Training curricula and materials were developed for six job areas: cook, clerk, communications, combat, mechanic and medic.

The six week course, taken prior to technical training, consisted of two parts. Part one focussed on reading-to-do skills, while part two focussed on reading-to-learn skills.

Reading-to-do. The reading to do strand consisted of six self-paced, mastery modules. Each module taught one of six fundamental job reading tasks. Reading-to-do tasks focussed on using printed material to search for information, such as the catalog number of an engine part. These tasks include: (a) using a table of contents; (b) using an index; (c) using tables and graphs; (d) using the body of a manual; (e) using procedural

direction forms; and (f) using job-specific forms. An example exercise for using a table of contents is pictured in Figure XX (Sticht, 1987).

Reading-to-learn. In comparison to part one, the second part, reading-to-learn, was a teacher-paced segment. The goal of part two was to teach many of the concepts and terms that recruits would encounter in job training. In addition, recruits learned reading comprehension skills. These skills included: changing text to pictures, changing text to tables, changing text to flow diagrams, identifying main points, paraphrasing, outlining and summarizing text. All of these skills were taught using information based on the materials soldiers would encounter on the job (Sticht, 1987).

Anchored Instruction

For the past few years, a research team at Vanderbilt's Learning Technology Center has been experimenting with interactive video-disc to design educational programs based on cognitive apprenticeship. The model is called anchored instruction because the practice of target skills is "anchored" to a specific context, termed a "macrocontext" in which students use target skills in order to solve a series of problems.

Two project series were developed. Both are aimed at elementary school children. The first, called the Young Sherlock project, is designed to help students learn language arts and social studies. The other, called the Jasper Series, focusses primarily on mathematical problem solving. (The results of the

Jasper project is being presented at another symposium at AERA, 1991.)

Young Sherlock. One of the goals of the Young Sherlock project was to improve the writing skills of 5th grade students. Four groups (Average-Experimental, At-Risk-Control, Average-Experimental, and At-Risk-Control) of students received instruction in writing for four hours each week for the entire school year. Writing instruction for the experimental group was anchored to the movies, The Young Sherlock Holmes and Oliver Twist. Both movies had the same historical setting. The comparison group received the same amount of instruction and addressed the same issues and skills as the experimental group. The story contexts, however, varied from lesson to lesson, often in the format of traditional basal readers. For example, one lesson focussed on the analysis of a folk tale while the next was about a murder mystery.

What is the Role of Contextualized Instruction?

Instruction is usually considered meaningful when the behavior transfers to other settings, persons, and time. One of the primary criteria for evaluating instruction, then, is transfer, also called generalization. Most would agree that one of the primary goals of contextualized instruction is to teach for transfer -- that is, to increase the likelihood that what is taught in the training or classroom setting will be used in future applicable settings. If educators, particularly those interested in contextualized instruction, are interested in

teaching for transfer, it may be beneficial to look at a well developed technology of generalization.

While other fields recognize the importance of transfer, and the conditions under which it occurs, behavior analysts have developed a detailed technology to promote generalization (Glaser & Bassok, 1989). The technology includes techniques that manipulate critical stimuli, manipulate target behaviors, and manipulate reinforcement contingencies. Stokes & Baer (1977) defined generalization as "the occurrence of relevant behavior under different, nontraining conditions (i.e. across subjects, settings, people, behaviors, and/or time) without the scheduling of events in those conditions as had been scheduled in the training conditions" (p.350).

Many of the techniques can be summarized as: **Teach Relevant Behaviors in Relevant Contexts**. If an instructional technology is going to increase the likelihood of transfer, or generalization, it must teach relevant behaviors in relevant contexts. Relevant behaviors have utility, and practicality. they are desirable to the student and are adaptable. In addition, the student is taught enough appropriate variations of the behavior in order to apply it in a number of situations. Relevant contexts are characterized by the critical features of target settings. Teaching in a relevant context means introducing, as much as is possible, all of the conditions found in target settings. A number of tactics have been developed to both introduce and highlight critical features. They include:

introduce maintaining contingencies, use common stimuli, use sufficient exemplars, train loosely and promote precision. Each of these techniques will be described in greater detail in this section.

Teaching Relevant Behavior

Essentially, the skill to be learned should be "context relevant" (Sailor, Goetz, Anderson, Hunt & Gee, 1988). Sailor, et al. (1988) operationalize relevancy by the following dimensions: (a) the skill to be learned must have utility -- it either produces something useful for the student or is a part of a broader skill that does so; (b) the skill has desirability -- it produces something for the student that would likely be chosen by the student if an appropriate choice situation were arranged; (c) the skill has practicality - it is likely to be needed with reasonable frequency; and (d) the skill is adaptable. To achieve adaptability it is often necessary to teach many, or all, of the relevant forms of that behavior -- more formally called teaching sufficient response exemplars.

Use sufficient response exemplars. When several variations of the same response are needed for the skill to be truly useful, a sufficient number of examples of each behavior should be included (Stokes & Osnes, 1988). For example, when teaching a child to "move the cursor" on a computer screen, you do not want to practice using only the keyboard or a mouse. Rather you should teach them to use the keyboard, and use a one, two, or three button mouse.

Teach in Relevant Contexts

Ideally, a skill should be acquired in the context (both physically and socially) in which it will be required. Brown, Collins and Duguid (1989) referred to this as an authentic setting. Though this is not always possible, educators should strive to create a relevant context in training.

A relevant context is one that incorporates critical elements and highlights those elements in training. The techniques included in this category are: introduce natural maintaining contingencies; train loosely; use common stimuli; train sufficient stimulus exemplars and promote generalization with precision by using negative examples.

Use common stimuli. The educator can facilitate generalization by identifying and integrating naturally occurring critical features into training. If stimuli are common to both training and generalization settings, and if the stimuli play a salient role in training, then the presence of the same stimuli in generalization settings may facilitate performance (Stokes & Osnes, 1988). When teaching adults to read, for example, materials and vocabulary should resemble reading matter that adults are likely to encounter in their daily lives.

Train sufficient stimulus exemplars. Often, a number of examples are required before generalized responding occurs. For example, instruction to teach a child to appropriately say "b" should include many types of "b" (e.g. B, b, and the script versions of each). Otherwise the child may learn to only say "b"

to the letter style used in training. Teaching a child to write in full sentences is another example. Training should not be restricted to English lessons, but should also occur in mathematics, social studies, history or art lessons. In addition, all of the child's teachers should require writing in full sentences. Otherwise, "writing in full sentences" may occur only during English lessons or only with one teacher.

Generalization with precision. To be most functional, however, generalization must occur with precision (Horner, Albin, & Ralph, 1986). That is, the learner should know when not to perform a response as well as when the response should occur (Horner, Eberhard, & Sheehan, 1986). To produce important behavioral changes, a technology of generalization should teach skills that are performed across the full range of appropriate, nontrained conditions that learners will encounter and not performed in inappropriate conditions (Albin & Horner, 1988; Horner, Bellamy & Colvin, 1984).

According to Engelmann and Carnine (1982) to promote precision and reduce errors, instruction must "show the limits of permissible variation by presenting negative examples" (p. 6). Instruction should show the student when not to behave in a certain way as well as when to behave. For example, instruction designed to teach a child to appropriately say "b" should not only include many types of "b" but also include letters that are "not b" (e.g. p, t, d). A negative example is one in which the learner should not perform the target response. Typically,

negative examples are very similar to the positive examples except that they do not contain the relevant, or critical, features. It is not enough to select negative teaching examples that simply do not contain the relevant stimulus features of the positive stimuli (maximally different). Rather, to develop precision negative teaching examples, some examples must be only minimally different. Minimally different negative examples share as many nonrelevant features as possible with the positive examples (Horner, Albin & Ralph, 1986).

Train loosely. In many ways, this is the opposite of strict discrimination training. The conditions of the training exemplars are varied so that only the relevant stimuli are consistently present and control behavior (Stokes & Baer, 1977). This procedure can reduce the chance that irrelevant stimuli will control behavior. For example, Bransford (1979) reported that many students knew that problems posed at the end of a chapter required application of the concepts and operations introduced in that chapter, and, in large part, selected their solution procedures based on the location of problem in the textbook, rather than on the basis of the critical features of the problems. To avoid location as a controlling factor, students could be asked to solve problems related to concepts introduced in earlier lessons.

Generalization Errors

When relevant behaviors have not been taught in relevant contexts, errors in transfer settings are more likely to occur --

either the behavior occurs in an inappropriate situation or fails to be performed in an appropriate situation. Elsewhere, the latter error has been called "inert knowledge" (Bransford, J., Sherwood, R., Vye, N., & Reiser, J. 1986). Horner et al. (1982) describe three causes of generalization errors: 1) irrelevant stimuli control the target response; 2) restricted stimulus control; and 3) limited variations of the target response.

Irrelevant stimuli control the target response. If responding comes under the control of irrelevant stimuli, an error pattern develops in which the response occurs in appropriate conditions that contain the irrelevant stimuli, occurs in inappropriate conditions that contain the irrelevant stimuli and do not occur in appropriate situations the do not contain the irrelevant stimuli (Horner et al., 1984).

Engelmann and Carnine (1982) contribute this control to training procedures that systematically pair responding in the presence of both relevant and irrelevant stimuli with reinforcement. If irrelevant stimuli are consistently paired with reinforcement, the student may learn to treat irrelevant stimuli as if they are relevant. For example, a student may only learn to use a specific algebraic formula when working pulley problems. Though the pulley is a superficial characteristic, if it is consistently paired with the successful application of a specific formula, the student may only use the formula when given a pulley problem and may not use the formula in other applicable situations.

Restricted stimulus control. Restricted stimulus control exists when a response that should be under the control of multiple relevant stimuli or multiple characteristics of a relevant stimulus is only controlled by a subset of those stimuli. If all members of a stimulus class contain a group relevant characteristics, and if examples trained during instruction permit the inference that only some of those characteristics are relevant, the learner will likely make errors by responding to new examples that contain only a subset of the relevant stimulus characteristics (Horner, et al., 1982; Horner, et al., 1984).

For example, Horner, et al. (1986) trained four mentally retarded adults to bus tables in a cafeteria. In order to correctly decide whether a table should be bused, the students had to attend to several features: whether people were sitting at the table, whether the people were eating; whether or not the dishes had food on them, whether garbage was present; and where the garbage was. If the students only attended to a few of these features, they would either fail to bus appropriate tables or inappropriately attempt to bus a table.

Limited variations of the target response. Often, students will learn only one form of a target response. In the natural environment, however, responding often involves minor variations on the topography of a response (Horner, et al., 1984). Using a mouse-controlled cursor on a computer, for example, may mean learning to move the mouse and press one, two, or three buttons,

depending on the type of mouse. If training is restricted to a one-button mouse, a student may be ill-prepared when facing two- and three- button mice.

Are Relevant Behaviors Being Taught in Relevant Contexts? Does FCE Teach Relevant Behaviors in Relevant Contexts?

FCE appears to teach students relevant behaviors. First, students learn to use reading materials in different ways for different purposes (to-do vs. to-learn) Second, FCE teaches students to monitor comprehension -- a metacognitive skill proven to be essential to reading -- by using transformation techniques such as outlining, summarizing, paraphrasing and changing text to tables, diagrams and flowcharts. The students are learning the monitoring techniques in a way that has utility and is practical because they are using vocabulary and materials that they need for training and work. The results Sticht et. al (1987) report reinforce the notion of relevancy because the students a) perform better on a vocational literacy exam rather than a general literacy exam and b) they perform better than a comparison group trained in a traditional (decontextualized) literacy program. Students in the FCE program posted gains in both general and specific reading skills. Whereas general reading ability increased by less than one grade level, though, specific literacy skills improved an average of 2.1 grade levels (Sticht, 1987). In comparison, two groups of soldiers enrolled in general literacy programs showed gains of less than one grade level in both general and specific literacy skills (Sticht, et. al, 1987).

Does AI teach Relevant Behaviors in Relevant Contexts?

Initially, it would seem so. The experimental subjects outperform the control subjects in both writing skills and content knowledge. Risko, Kinzer, Vye, and Rowe (1990) reported that stories written by students in the anchored condition contained more story elements, the plots were more likely to link character actions; and events were more likely to be linked to goal statements and resolutions. In addition, students in the anchored condition, recalled more factual information about Victorian England than did control subjects (Vye, Rowe, Kinzer, & Risko, 1990). In both cases, anchored instruction had the greatest benefit for at-risk children.

A confound exists, however, because of the inconsistency in medium (print vs. video) between the experimental and control groups. Because of this confound, the results cannot completely be attributed to a consistent context learning. In addition, the true relevancy of the context is unclear. This is to be expected to some degree because of the population with which the group is working. It is far easier to identify target settings, and hence, relevant contexts when working with adults as opposed to children. However, the context chosen is one that many of the children may find entertaining.

Conclusion

Though FCE appears to teach relevant behaviors in relevant contexts, it is not as clear whether anchored instruction does

the same. This is important because when teachers teach skills in consistent and relevant contexts, they are better able to identify and integrate critical features into training. They are also more likely to be able to identify and teach appropriate variations of a skill. Finally, they are more likely to be able to identify similar by inappropriate situations (negative examples), hence promote generalization with precision. Many of the principles adhered to by proponents of contextualized instruction are also adhered to by proponent of generalization technology. Those interested in designing contextualized instruction, then, may benefit by looking at other techniques and analyses in discussed in the generalization literature to further aid the analysis and improvement of contextualized instruction.

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